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Abstract

STRENGTH PROBLEMS OF THE FLANGED JOINT

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The successful solution of the removable joint of the cover with the bulk is one of the main problems in many nuclear power reactors. The importance of the reliable design of this joint rises with enlarging the diameter of the vessel.

The task arises in this connection to apply some of the classical flanged joint types or its modification to an extremely large and troublesome vessel. Various classical flanged joint types of course have not the same prospect to application in enlarging the vessel.

Therefore it is necessary in the first place to select the suitable type of the joint (type optimization) and further to select detailed dimensions (shape optimization). In this way it is possible to find technologically feasible shapes for the most challenging working régime, to eliminate undesirable bending stresses and to let the membrane stresses only.

As the model realization of both these optimizations is not economic, either timely or financially, one must optimize in the analytical way using an automatic computer. The designer gets satisfactory data for designing the joint in several hours. To check this design it is sufficient to gauge one chosen variant only.

Three types of the flanged joint were analysed for a vessel of 6000 mm diameter, about 70 at gauge pressure, with temperature differences in the joint in the order of several tens degrees centigrade, with pressing seal force equalling approximately 50% of the force acting on the cover and with further given technological and material conditions.

The joint with free flanges proved optimal and for this type the procedure of shape optimization is mentioned. To carry it out successfully and

fast it is necessary to gain curves of characteristic dependences of the stress in important cross-sections upon particular dimension changes.

The basis is the general strength analysis of a joint with free flanges carried out in the method of forces and processed into a program for an automatic computer. After designing the base dimensional variant approximately in the range of parameters of the vessel for which the joint is optimized, the system of dimensional variations is carried out. The influence of these dimensional changes upon the stress in important cross-sections of the joint is introduced in graphs. According to the character of the curves one may draw conclusions not only about the possibilities of the base dimensional variant but about the whole junction behaviour as well.

By means of gained information it is possible to achieve optimal shapes in a wide range of the vessel parameters with minimal number of further variants.

The paper is completed with graphs of characteristic curves for a joint with free flanges.